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VEHICLE HEATER WITHN A BURNER AS WELL AS MODE OF OPERATION HEREFOR
[FAHRZEUG -HEIZGERAET MIT EINEM BRENNER SOWIE BETRIEBSVERFAHREN
HIERFUER]

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Description

The invention concerns a method for operating a vehicle heater with a burner and a fuel injection device, the injected amount of fuel being variable in order to influence the heating capacity.

Vehicle heaters with their own burners for the most part are used for standard heating, but also can be used for supplementary heating when the vehicle heater proper, that uses the waste heat of an engine driving the vehicle, cannot provide sufficient heating capacity. Supplementary or standard heaters of this kind are operated, for example in the case of motor vehicles driven by internal combustion engines, with the same liquid fuel that also is used for the internal combustion engine.

The construction of vehicle heaters of this kind with a burner should be as simple as possible and still function reliably. In addition, it should be possible to influence the heating capacity by changing the injected amount of fuel. For example, DE 40 07 699 A1 describes a possibility of changing the amount of fuel injected into the burner consists in changing the feed rate of a fuel pump. However, in this case limits are imposed on the fuel consumption in partial load operation, since in the case of a reduced feed rate there is also only a reduced fuel pressure, so that the danger of extinguishing the flame in the burner also exists. The regulating capacity, in particular in the lower partial load range in the known cycling operation of fuel pumps, also leaves something to be desired.

Therefore the object of the invention is to show measures by means of which the variable amount of fuel can be portioned more accurately, without the danger of extinguishing the burner existing here.

The further object of presenting a particularly advantageous vehicle heater for performing this mode of operation is given by the fact that the fuel injection device is made as a pressure injection device.

Every possible partial load operating point of a vehicle heater can be optimally adjusted with an intermittent, respectively timed fuel injection. Individually, only the amount of fuel desired in each case can be supplied while maintaining the desired injection pressures, when the fuel feed is no longer continuous, but in each case takes place uninterrupted for the short time. In this case it is possible to influence the amount of fuel actually supplied in different ways. Thus, not only is it possible to influence the timing, but also the amount of fuel actually injected during each injection. In this case it is particularly advantageous to fall back on known high-pressure injection in connection with the fuel supply of internal combustion engines.

This makes it possible to obtain a timed/intermittent fuel injection, without a relatively expensive control or design fuel injection element being necessary. A further advantage of the high-pressure fuel injection, that also is described in DE-OS 20 09 322, is the relatively low required fuel pump feed rate. A vehicle heater

also is less subject to problems with respect to sooting.

In the case of high-pressure injection a pressure pulse is created by closing a shut-off element, that opens the path for the fuel to or via a fuel injection element, so that a short-term fuel injection can take place triggered by this pressure pulse. Thus is also is possible to change the injection frequency by varying the operating frequency of this shut-off element, so that the injected amount of fuel can be controlled with this. In particular it is also possible not to operate shut-off element at all. Then a continuous fuel injection can take place so that then the burner and the heater develop their maximum heating capacity. However, it is also possible to keep the operating frequency of the shut-off element constant and to change the amount of fuel introduced per injection process for influencing the heating capacity. Also this is possible without expensive engagement of the fuel injection element or the fuel pump, when a non-return valve opening to the injection element is provided with variable closing force in the fuel line between the fuel injection element and the shut-off element producing the pressure pulse. Independent of the injection frequency, thus this non-return valve can let a greater or smaller amount of fuel per injection pass through by changing the closing force. In this case the closing force can be varied mechanically, hydraulically, electrically, or pneumatically.

Pressure tanks, respectively supply containers in the low pressure part and/or in the high pressure part of the high-pressure

fuel injection can have an advantageous effect on the injection continuity. This and other advantages also are evident from the following description of a preferred embodiment of the invention shown only in a basic diagram.

In a burner 1, shown only in abstract form, of a vehicle heater nor shown in greater detail, a fuel injection element 2, via which the fuel is delivered, is projected inward. This fuel injection element 2 is supplied with fuel from a fuel storage tank 3 via a high-pressure fuel injection device designates as 4 in its entirety.

In particular, this high-pressure fuel injection device 4 consists of a flow line 5, in which a fuel pump 6 operated continuously at the time of operating the vehicle heater is supplied.

A low pressure reservoir 7 is connected to the flow line 5 downstream of the fuel pump 6. A return line 9 opening in the storage tank 3 branches from the flow line 5 with the intermediate connection of a shut-off element 8 downstream of the low pressure reservoir.

The flow line 5 continues, bypassing the shut-off element 8, and opens by passing through a non-return valve 10 in a high-pressure line 11, to which the injection element 2 is finally connected.

The closing force of the non-return valve 10 is variable in a way not shown in further detail; this is represented symbolically by the arrow crossing the non-return valve also shown only symbolically. A high pressure reservoir 12 also is connected to the high pressure line 11; in this case both the high pressure reservoir 12 and the low

pressure reservoir 7 are made as pressure-loaded storage volumes branching from the fuel line proper (flow line 5, respectively high pressure line 11).

As already explained, the fuel pump 6 operates continuously and in this case only has to be designed for a relatively low pressure level, since in the case of high pressure injection an adjusting pressure pulse downstream of the fuel pump 6. This pressure pulse is built up by an abrupt closing of the shut-off element 8, as is briefly explained below. In this case, the shut-off element 8 first is in a position opening the return line 9. The fuel stream delivered by the fuel pump 6 thus flows continuously through the return line 10 back into the storage tank, without reaching the high pressure line 11, since the feed pressure of the fuel pressure 6 is not sufficient to overcome the closing force of the non-return valve 10. If the shut-off element 8 is now closed abruptly, an elevated fuel pressure quickly builds up in the flow line 5 downstream of the fuel pump 6. This elevated pressure is sufficient to overcome the closing force of the non-return valve 10, so that now fuel can reach the high pressure line 11 in a pressure pulse. After the pressure peak that occurs when the shut-off element is closed drops, the non-return valve 10 closes again. If the shut-off element 8 is now opened, the process described can begin again, that is, a new closing of the shut-off element 8 generates a new pressure pulse, that can advance through the non-return valve 10 to the fuel injection element 2 and thus causes a

short-term fuel injection into the burner 1.

Preferably the closing force of the non-return valve 10 is adjustable. This change in the closing force can be converted by shifting the support point of a spring element located in the non-return valve 10. Thus the amount of fuel reaching the high pressure line 11 per pressure pulse via the non-return line 10 can be influenced by this closing force variation. Thus the amount of fuel reaching the burner 1 per injection process can be changed without changing the timing frequency of the pressure pulse injection, this timing frequency being determined by the operating frequency of the shut-off element. Thus the heating capacity of the vehicle heater can be controlled in a simple way. In this case, it is also possible to achieve a maximum heating capacity by continuous fuel feed. For this, the closing force on the non-return valve 10 must be reduced so much that the feed pressure of the fuel pump 6 is sufficient to open the non-return valve 10. Of course, in the case of this continuous injection the shut-off element remains in the position closing the return line 9.

An optimal combustion in the burner 1 always occurs with the described intermittent, respectively timed fuel injection at least in the partial load operation of the heating device. The heating capacity can be portioned correctly in a wide range. Extremely simple and reliable components are still used, in particular with the assistance of pressure pulse injection. Also, the fuel pump 6 only must provide a relatively low feed pressure, still in order to achieve

an intermittent high pressure injection in the burner 1. However, details, that were described in connection with the preferred embodiment, can be configured completely otherwise, without departing from the content of the Patent Claims.

Patent Claims

1. A method for operating a vehicle heater with a burner (1) and a fuel injection device (4), the injected amount of fuel being variable, wherein the fuel is injected intermittently/time at least in partial load operation.

2. The vehicle heater with a burner (1) and a fuel injection device, the injected amount of fuel being variable, in order to influence the heating capacity, characterized by a pressure pulse fuel injection device (4).

3. The vehicle heating device according to Claim 1, wherein the operating frequency of a shut-off element (8) causing the pressure pulse.

4. The vehicle heater according to Claim 2 or 3, characterized by a non-return valve (10) with variable closing force, located between the fuel injection element (2) and the shut-off element causing the pressure pulse.

5. The vehicle heater according to one of the Claims 2 to 4, characterized by a low pressure reservoir (7) connected to the fuel line (flow line 5) downstream of the shut-off element (8) and/or a high pressure reservoir (12) connected to the fuel line (high pressure line 11) between the fuel injection element (2) and the shut-off

element (8) or the non-return valve (10).

1 page of drawings appended

